



[4910-13-P]

**DEPARTMENT OF TRANSPORTATION**

**Federal Aviation Administration**

**14 CFR Part 39**

**[Docket No. FAA-2010-0494; Directorate Identifier 2010-NE-20-AD; Amendment 39-16884; AD 2011-25-08]**

**RIN 2120-AA64**

**Airworthiness Directives; International Aero Engines Turbofan Engines**

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Final rule.

**SUMMARY:** We are adopting a new airworthiness directive (AD) for International Aero Engines (IAE) V2500-A1, V2522-A5, V2524-A5, V2525-D5, V2527-A5, V2527E-A5, V2527M-A5, V2528-D5, V2530-A5, and V2533-A5 turbofan engines. This AD was prompted by three reports of high-pressure turbine (HPT) case burn-through events, numerous reports of loss of stage 1 blade outer air seal segments, and HPT case bulging. This AD requires initial and repetitive 360 degree borescope inspections of HPT stage 1 blade outer air seal segments for evidence of certain distress conditions. This AD also requires incorporation of improved durability stage 1 blade outer air seal segments at the next exposure to the HPT module subassembly as terminating action to the repetitive inspections. We are issuing this AD to prevent HPT case burn-through, uncontrolled under-cowl engine fire, and damage to the airplane.

**DATES:** This AD is effective [INSERT DATE 35 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

The Director of the Federal Register approved the incorporation by reference of certain publications listed in the AD as of [INSERT DATE 35 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

**ADDRESSES:** For service information identified in this AD, contact International Aero Engines AG, 628 Hebron Avenue, Suite 400, Glastonbury, CT 06033; phone: 860-368-3700; fax: 860-368-4600; e-mail: [iaeinfo@iaev2500.com](mailto:iaeinfo@iaev2500.com); website:

<https://www.iaeworld.com>. You may review copies of the referenced service information at the FAA, Engine & Propeller Directorate, 12 New England Executive Park, Burlington, MA 01803. For information on the availability of this material at the FAA, call 781-238-7125.

### **Examining the AD Docket**

You may examine the AD docket on the Internet at <http://www.regulations.gov>; or in person at the Docket Management Facility between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. The AD docket contains this AD, the regulatory evaluation, any comments received, and other information. The address for the Docket Office (phone: 800-647-5527) is Document Management Facility, U.S. Department of Transportation, Docket Operations, M-30, West Building Ground Floor, Room W12-140, 1200 New Jersey Avenue SE., Washington, DC 20590.

**FOR FURTHER INFORMATION CONTACT:** Carlos Fernandes, Aerospace Engineer, Engine Certification Office, FAA, Engine & Propeller Directorate, 12 New England Executive Park, Burlington, MA 01803; phone: 781-238-7189; fax: 781-238-7199, e-mail: [carlos.fernandes@faa.gov](mailto:carlos.fernandes@faa.gov).

### **SUPPLEMENTARY INFORMATION:**

#### **Discussion**

We issued a notice of proposed rulemaking (NPRM) to amend 14 CFR part 39 to include an AD that would apply to the specified products. That NPRM published in the Federal Register on November 23, 2010 (75 FR 71373). That NPRM proposed to require initial and repetitive 360 degree borescope inspections of HPT stage 1 blade outer air seal segments for evidence of distress. That NPRM also proposed to require incorporation of

improved design stage 1 blade outer air seal segments at the next exposure to the HPT module subassembly.

## **Comments**

We gave the public the opportunity to participate in developing this AD. The following presents the comments received on the proposal and the FAA's response to each comment.

### **Request to Increase Repetitive Inspection Interval**

A commenter, JetBlue Airways (JetBlue), requested that the repetitive borescope inspection interval be increased from 1,200 hours to either 1,500 or 2,000 hours. JetBlue requested the change to coincide with the recent extension of its JetBlue maintenance check to 1,500 hours or its existing borescope inspection interval of 2,000 hours per its maintenance planning document.

We disagree. We based the 1,200 hour interval on risk analysis and it demonstrates a minimum level of safety. JetBlue did not offer data to support an increase in the repetitive inspection interval. We did not change the AD in response to this comment.

### **Request to Use Modified Parts that have been Reworked**

Three commenters, Lufthansa Technik AG, United Airlines, and TAM Airlines, requested that the FAA allow use of modified parts that have been reworked as a terminating action.

We disagree. The commenters did not provide data to suggest that the modified parts would correct the unsafe condition. Applicants are allowed to propose alternative methods of compliance per paragraph (h) of this AD. We did not change the AD in response to this comment.

## **Request to Make Compliance not Based on Exhaust Gas Temperature (EGT)**

### **Margin**

One commenter, Japan Airlines, asked that compliance be changed so it does not depend on EGT margin or so that a longer period of time is allowed to check EGT margin.

We disagree. The unsafe condition identified in this AD develops due to blade outer air seal degradation which is related to reduced EGT margin. The EGT margin criteria in Table 1 of the compliance section of this AD were developed based on field data. Operators who lack EGT margin capture systems may develop an acceptable method to evaluate EGT margin or assume the EGT margin criteria in Table 1 have been met. We did not change the AD in response to this comment.

### **Request to Clarify EGT Margin**

Three commenters, United Airlines, Japan Airlines, and Delta Airlines, requested that EGT margin be clarified.

We agree. We revised paragraph (f) of this AD by providing additional guidance on EGT margin.

### **Request to Establish Corrective Action for each Operator's Environment**

One commenter, Japan Airlines, asked that corrective action be established for each operator's operational environment. The commenter believes this change is justified because its blade outer air seals (BOASS) are in good condition.

We disagree. The EGT margin requirement in this AD accounts for the operating environment. The calculation of operating hours to inspect begins when all three criteria in Table 1 exceed requirements. We did not change the AD in response to this comment.

### **Request to Vary EGT Margin**

Two commenters, Japan Airlines and TAM Airlines, requested to vary EGT margin based on EGT redline/thrust level. The commenters believe EGT trigger margin is too high and should be reduced.

We disagree. EGT margin will vary based on thrust level so there is no need to reduce or vary it. We have also seen reports that lower redline/thrust engines with 45 degree Celsius margins have also experienced BOAS damage. We did not change the AD in response to this comment.

### **Request to Address Intersecting Axial and Circumferential Cracks**

One commenter, Delta Airlines, asked that we address intersecting axial and circumferential cracks.

We agree. We revised the AD by updating the SB V2500-ENG-72-0580 from revision 2 to revision 3 in paragraph (f), “Borescope Inspections.” Revision 3 of this SB provides revised criteria for intersecting axial and circumferential cracks.

### **Request to Clarify Terminating Action Requirement**

One commenter, Delta Airlines, asked that we clarify the terminating action requirement. Delta Airlines indicated that it is unclear if the terminating action for this AD is required or is optional and requested further definition of the HPT module exposure. Delta Airlines also asked that the paragraph in the terminating action requirement that refers to concurrent requirements be modified to identify the piece part stage 1 support assembly.

We agree. Terminating action is mandatory. To eliminate any uncertainty, we revised the heading of the “Terminating Action” paragraph to “Mandatory Terminating Action” to clarify that this action is required. We also added a definition of HPT module exposure to the Mandatory Terminating Action paragraph to improve clarity. We further

modified this paragraph by changing the concurrent requirement paragraph references to identify the piece part stage 1 support assembly.

#### **Request to Change Engine Inspection Criteria**

One commenter, TAM Airlines, requested that the criteria for engine inspection be determined by EGT margin deterioration rate instead of a fixed EGT margin value. TAM Airlines asked that the current engine inspection criteria be merged with high EGT margin deterioration rate (°C/1000FH) and or EGT margin abrupt trend shifts.

We disagree. EGT margin allows the operator to use more of the available stage 1 blade outer air seal segments life and correlates with the air seal degradation. We did not change the AD in response to this comment.

#### **Request to Provide Guidance on Engine Position Changes**

One commenter, TAM Airlines, asked for guidance on how to manage engine position changes after going back above the EGT margin threshold.

We agree. We revised the Borescope Inspections paragraph to provide additional clarification on engine position changes.

#### **Additional Information on Unsafe Condition**

One commenter, Airbus, supported the FAA's position on repetitive inspections and noted that the potential pylon lower spar damage caused by HPT case burn-through would not prevent continued safe flight and landing of the aircraft.

We disagree. The description used in the AD adequately describes the unsafe condition. We did not change the AD in response to this comment.

#### **Conclusion**

We reviewed the relevant data, considered the comments received, and determined that air safety and the public interest require adopting the AD with the changes described previously and minor editorial changes. We have determined that these minor changes:

- Are consistent with the intent that was proposed in the NPRM (75 FR 71373, November 23, 2010) for correcting the unsafe condition; and
- Do not add any additional burden upon the public than was already proposed in the NPRM (75 FR 71373, November 23, 2010).

We also determined that these changes will not increase the economic burden on any operator or increase the scope of the AD.

### **Costs of Compliance**

We estimate that this AD affects 34 V2500 A1 series and 510 V2500 A5/D5 series engines installed on airplanes of U.S. registry. We also estimate that it will take about 3 work-hours per engine to perform one inspection, about 3 work-hours per engine to install the improved durability stage 1 blade outer air seal segments, and that the average labor rate is \$85 per work-hour. Required parts cost about \$150,882 (V2500 A1 series) and \$155,195 (V2500 A5/D5 series) per engine. Based on these figures, we estimate the total cost of the AD to U.S. operators to be \$84,556,878.

### **Authority for this Rulemaking**

Title 49 of the United States Code specifies the FAA's authority to issue rules on aviation safety. Subtitle I, section 106, describes the authority of the FAA Administrator. Subtitle VII: Aviation Programs, describes in more detail the scope of the Agency's authority.

We are issuing this rulemaking under the authority described in Subtitle VII, Part A, Subpart III, Section 44701: "General requirements." Under that section, Congress charges the FAA with promoting safe flight of civil aircraft in air commerce by prescribing regulations for practices, methods, and procedures the Administrator finds necessary for safety in air commerce. This regulation is within the scope of that authority because it addresses an unsafe condition that is likely to exist or develop on products identified in this rulemaking action.

## **Regulatory Findings**

This AD will not have federalism implications under Executive Order 13132. This AD will not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.

For the reasons discussed above, I certify that this AD:

- (1) Is not a “significant regulatory action” under Executive Order 12866,
- (2) Is not a “significant rule” under DOT Regulatory Policies and Procedures (44 FR 11034, February 26, 1979),
- (3) Will not affect intrastate aviation in Alaska, and
- (4) Will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act.

## **List of Subjects in 14 CFR Part 39**

Air transportation, Aircraft, Aviation safety, Incorporation by reference, Safety.

## **Adoption of the Amendment**

Accordingly, under the authority delegated to me by the Administrator, the FAA amends 14 CFR part 39 as follows:

### **PART 39 - AIRWORTHINESS DIRECTIVES**

- 1. The authority citation for part 39 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701.

#### **§ 39.13 [Amended]**

- 2. The FAA amends § 39.13 by adding the following new airworthiness directive (AD):

2011-25-08 **International Aero Engines:** Amendment 39-16884; Docket No. FAA-2010-0494; Directorate Identifier 2010-NE-20-AD.



**(a) Effective Date**

This AD is effective [INSERT DATE 35 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

**(b) Affected ADs**

None.

**(c) Applicability**

This AD applies to International Aero Engines (IAE) V2500-A1, V2522-A5, V2524-A5, V2525-D5, V2527-A5, V2527E-A5, V2527M-A5, V2528-D5, V2530-A5, and V2533-A5 turbofan engines.

**(d) Unsafe Condition**

This AD results from three reports received of high-pressure turbine (HPT) case burn-through events. There have also been numerous shop reports of loss of stage 1 blade outer air seal segments, and HPT case bulging. We are issuing this AD to prevent HPT case burn-through, uncontrolled under-cowl engine fire, and damage to the airplane.

**(e) Compliance**

(1) You are responsible for having the actions required by this AD performed within the compliance times specified unless the actions have already been done.

(2) For engines that have incorporated IAE Service Bulletin (SB) No. V2500-ENG-72-0483, Revision 3 or earlier, or IAE SB No. V2500-ENG-72-0542, Revision 1 or earlier, no further action is required.

**(f) Borescope Inspections**

(1) Perform 360 degree borescope inspections of the HPT stage 1 blade outer air seal segments for evidence of the distress conditions listed in Appendix D of IAE SB No. V2500-ENG-72-0580, Revision 3, dated August 23, 2011.

(2) For V2525-D5 and V2528-D5 turbofan engines:

(i) Inspect within 1,000 operating hours after the engine meets all criteria as defined in Table 1 of this AD, or within 600 operating hours after the effective date of this AD, whichever is greater.

(ii) Thereafter, re-inspect within every 1,000 operating hours or as defined in Appendix D of IAE SB No. V2500-ENG-72-0580, Revision 3, dated August 23, 2011, whichever is less.

(iii) Use Accomplishment Instructions paragraphs 3.B.(1) through 3.B.(3), and Appendices A through D of IAE SB No. V2500-ENG-72-0580, Revision 3, dated August 23, 2011, to do these inspections.

(3) For V2500-A1, V2522-A5, V2524-A5, V2527-A5, V2527E-A5, V2527M-A5, V2530-A5, and V2533-A5 turbofan engines:

(i) Inspect within 1,200 operating hours after the engine meets all criteria as defined in Table 1 of this AD, or within 600 operating hours after the effective date of this AD, whichever is greater.

(ii) Thereafter, re-inspect within every 1,200 operating hours or as defined in Appendix D of IAE SB No. V2500-ENG-72-0580, Revision 3, dated August 23, 2011, whichever is less.

(iii) Use Accomplishment Instructions paragraphs 3.A.(1) through 3.A.(3), and Appendices A through D of IAE SB No. V2500-ENG-72-0580, Revision 3, dated August 23, 2011, to do these inspections.

**Table 1 - Stage 1 Blade Outer Air Seal Segment Inspection Compliance Criteria**

<b>Engine Model</b>	<b>Stage 1 Blade Outer Air Seal Segments Hours-Since- New or Since- Last-Repair (greater than)</b>	<b>Stage 1 Blade Outer Air Seal Segments Cycles-Since- New or Since- Last-Repair (greater than)</b>	<b>Exhaust Gas Temperature Margin Degrees Celsius (less than)</b>
A1	6,000	3,800	45

<b>Engine Model</b>	<b>Stage 1 Blade Outer Air Seal Segments Hours-Since- New or Since- Last-Repair (greater than)</b>	<b>Stage 1 Blade Outer Air Seal Segments Cycles-Since- New or Since- Last-Repair (greater than)</b>	<b>Exhaust Gas Temperature Margin Degrees Celsius (less than)</b>
A5	6,000	3,500	45
D5	5,000	3,500	45

(4) Exhaust Gas Temperature Margin is defined as the expected margin during a sea-level takeoff on a 30-degree Celsius Outside Air Temperature Day. Guidance on how to calculate EGT margin can be found in IAE SIL 057. EGT margin smoothed data (data averaged over 6 consecutive flights) is to be compared with the criteria in Table 1. If a gap in EGT data exists due to temporary loss of data, you may use linear interpolation. Calculate operating hours from the point when all criteria exceed the requirements in Table 1.

(5) Except as provided below, the inspection of paragraphs (f)(2)(i) through (f)(2)(iii) and (f)(3)(i) through (f)(3)(iii) must be performed after all the criteria in Table 1 are satisfied; regardless of subsequent EGT margin calculations or engine rating changes. Temporary EGT margin excursions below the criteria in Table 1 that are corrected with simple troubleshooting methods (e.g., LRU (line replaceable unit) replacement or correction of a measurement error) do not constitute satisfying the criteria in Table 1.

**(g) Mandatory Terminating Action**

(1) As terminating action to the repetitive 360 degree borescope inspections required in paragraphs (f)(2)(ii) and (f)(3)(ii) above, install improved durability stage 1 blade outer air seal segments at the next HPT module subassembly exposure, which is defined as separation of the HPT module mating flanges.

(i) For V2500-A1 turbofan engines, use paragraphs 1.B., Concurrent Requirements, and paragraphs 3.(1)(a), 3.(1)(b)(iii), and 3.(2)(a) of the Accomplishment

Instructions of IAE SB No. V2500-ENG-72-0542, Revision 1, dated January 7, 2009, to do the installation.

(ii) For V2522-A5, V2524-A5, V2525-D5, V2527-A5, V2527E-A5, V2527M-A5, V2528-D5, V2530-A5, and V2533-A5 turbofan engines, use paragraphs 1.B., Concurrent Requirements, and paragraphs 3.(1)(a), 3.(1)(b), 3.(1)(c)(ii), and 3.(2)(a) of the Accomplishment Instructions of IAE SB No. V2500-ENG-72-0483, Revision 3, dated January 7, 2009, to do the installation.

(iii) Both IAE SBs No. V2500-ENG-72-0542, Revision 1, and SB No. V2500-ENG-72-0483, Revision 3, require modification of the stage 1 HPT support assembly before installing the new blade outer air seal segments. You must complete the modification using those SBs, as applicable to the appropriate engine model, to properly perform the mandatory terminating action of this AD.

#### **(h) Alternative Methods of Compliance**

The Manager, Engine Certification Office, may approve alternative methods of compliance for this AD. Use the procedures found in 14 CFR 39.19 to make your request.

#### **(i) Related Information**

(1) For more information about this AD, contact Carlos Fernandes, Aerospace Engineer, Engine Certification Office, FAA, Engine & Propeller Directorate, 12 New England Executive Park, Burlington, MA 01803; phone: 781-238-7189; fax: 781-238-7199; e-mail: [carlos.fernandes@faa.gov](mailto:carlos.fernandes@faa.gov).

(2) Contact International Aero Engines AG, 628 Hebron Avenue, Suite 400, Glastonbury, CT 06033; phone: 860-368-3700; fax: 860-368-4600; e-mail: [iaeinfo@iae2500.com](mailto:iaeinfo@iae2500.com); website: <https://www.iaeworld.com>; for a copy of the service information referenced in this AD.

**(j) Material Incorporated by Reference**

(1) You must use the following service information to do the actions required by this AD, unless the AD specifies otherwise. The Director of the Federal Register approved the incorporation by reference (IBR) under 5 U.S.C. 552(a) and 1 CFR part 51 of the following service information on the date specified:

(i) International Aero Engines (IAE) SB No. V2500-ENG-72-0580, Revision 3, dated August 23, 2011, approved for IBR [INSERT DATE 35 DAYS AFTER PUBLICATION].

(ii) IAE SB No. V2500-ENG-72-0542, Revision 1, dated January 7, 2009, approved for IBR [ INSERT DATE 35 DAYS AFTER PUBLICATION].

(iii) IAE SB No. V2500-ENG-72-0483, Revision 3, dated January 7, 2009, approved for IBR [INSERT DATE 35 DAYS AFTER PUBLICATION].

(2) For service information identified in this AD, contact International Aero Engines AG, 628 Hebron Avenue, Suite 400, Glastonbury, CT 06033; phone: 860-368-3700; fax: 860-368-4600; e-mail: [iaeinfo@iaev2500.com](mailto:iaeinfo@iaev2500.com); website: <https://www.iaeworld.com>.

(3) You may review copies of the service information at the FAA, Engine & Propeller Directorate, 12 New England Executive Park, Burlington, MA 01803. For information on the availability of this material at the FAA, call 781-238-7125.

(4) You may also review copies of the service information that is incorporated by reference at the National Archives and Records Administration (NARA). For information on the availability of this material at an NARA facility, call 202-741-6030, or go to [http://www.archives.gov/federal\\_register/code\\_of\\_federal\\_regulations/ibr\\_locations.html](http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html).

Issued in Burlington, MA, on November 30, 2011.

Peter A. White,  
Manager, Engine & Propeller Directorate,  
Aircraft Certification Service.

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